

CLAIMS

1. A method for metallurgically joining a first tube to a member comprising the steps of:
 - 5 a) obtaining a first tube having a flange;
 - b) obtaining a member;
 - c) after steps a) and b), disposing the first tube and the member with the flange contacting the member directly and/or indirectly through an intervening welding/brazing joining material, wherein at least one of the flange and the member is segmented, and wherein the contact between the flange and the member is a segmented contact at a plurality of spaced-apart contact areas
10 between the flange and the member;
 - d) after step c), creating a resistance welding/brazing current path through the first tube and the member at a first one of the plurality of contact areas creating a first weld/braze zone which includes at least some of the flange
15 and at least some of the member; and
 - e) after step d), creating a resistance welding /brazing current path through the first tube and the member at a different second one of the plurality of contact areas creating a second weld/braze zone which includes at least some
20 of the flange and at least some of the member.
2. The method of claim 1, wherein in step c) the welding/brazing joining material is either unattached to the flange and the member or is plated to at least one of the flange and the member.
- 25 3. The method of claim 1, wherein the flange is an annular outwardly-extending end flange disposed proximate an end of the first tube.
4. The method of claim 3, also including, during step d), the step of applying a force to relatively move the flange deformingly against the member at, and only
30 at the first one of the contact areas, and further including, during step e), the

step of applying a force to relatively move the flange deformingly against the member at, and only at, the second one of the contact areas.

- 5 5. The method of claim 3, wherein steps d) and e) are performed without applying a force to relatively move any portion of the flange deformingly against the member.
- 10 6. The method of claim 3, wherein the end flange includes a plurality of spaced-apart annular segments, and wherein the contact between the end flange and the member is a contact between each of the annular segments of the end flange and the member.
7. The method of claim 6, wherein the member is a second tube.
- 15 8. The method of claim 7, wherein the second tube has an annular outwardly-extending end flange, and wherein step c) disposes the first tube and the second tube with each of the annular segments of the flange of the first tube contacting the end flange of the second tube either directly and/or through an intervening welding/brazing joining material.
- 20 9. The method of claim 8, wherein the end flange of the second tube is a non-segmented end flange.
- 25 10. The method of claim 1, wherein the member is a non-tubular member (550).
- 30 11. The method of claim 6, wherein the member is a non-tubular member having a through hole (552), and wherein step c) coaxially aligns the first tube with the through hole of the non-tubular member with each of the annular segments of the flange of the first tube contacting the non-tubular member either directly or through an intervening welding/brazing joining material.

12. A method for metallurgically joining a first tube to a member comprising the steps of:

- a) obtaining a first tube having a flange;
- 5 b) obtaining a member;
- c) after steps a) and b), disposing the first tube and the member with the flange contacting the member directly and/or indirectly through an intervening welding joining material, wherein at least one of the flange and the member is segmented, and wherein the contact between the flange and the member is a segmented contact at a plurality of spaced-apart contact areas between the
10 flange and the member;
- d) after step c), creating a resistance welding current path through the first tube and the member at one of the plurality of contact areas creating a weld zone which includes at least some of the flange and at least some of the
15 member; and
- e) repeating step d) once for each of the remaining ones of the contact areas each time creating a different weld zone which includes at least some of the flange and at least some of the member.

20 13. The method of claim 12, wherein step c) disposes the first tube and the member with the flange contacting the member directly.

 14. The method of claim 12, wherein step c) disposes the first tube and the member with the flange contacting the member indirectly through an
25 intervening welding joining material, and wherein the intervening welding joining material is a filler metal ring disposed between and directly contacting the flange and the member.

 15. The method of claim 12, wherein the flange is an annular outwardly-
30 extending end flange having a plurality of spaced-apart annular segments, and

wherein the contact between the end flange and the member is a contact between each of the annular segments of the end flange and the member.

16. The method of claim 15, wherein the member is a second tube having an annular outwardly-extending end flange, wherein the end flange of the second tube is a non-segmented end flange, and wherein step c) disposes the first tube and the second tube with each of the annular segments of the flange of the first tube contacting the end flange of the second tube either directly or through an intervening welding joining material.

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17. A method for metallurgically joining a first tube to a member comprising the steps of:

a) obtaining a first tube having a flange;

b) obtaining a member;

15 c) after steps a) and b), disposing the first tube and the member with the flange contacting the member indirectly through an intervening brazing joining material, wherein at least one of the flange and the member is segmented, and wherein the contact between the flange and the member is a segmented contact at a plurality of spaced-apart contact areas between the flange and the member;

20 d) after step c), creating a resistance brazing current path through the first tube and the member at one of the plurality of contact areas creating a braze zone which includes at least some of the flange and at least some of the member; and

25 e) repeating step d) once for each of the remaining ones of the contact areas each time creating a different braze zone which includes at least some of the flange and at least some of the member.

18. The method of claim 17, wherein the brazing joining material is a brazing ring.

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19. The method of claim 17, wherein the flange is an annular outwardly-
extending end flange having a plurality of spaced-apart annular segments, and
wherein the contact between the end flange and the member is an indirect
contact between each of the annular segments of the end flange and the member
5 through the brazing joining material.

20. The method of claim 19, wherein the member is a second tube having an
annular outwardly-extending end flange, wherein the end flange of the second
tube is a non-segmented end flange, and wherein step c) disposes the first tube
10 and the second tube with each of the annular segments of the flange of the first
tube contacting the end flange of the second tube indirectly through an
intervening brazing joining material.